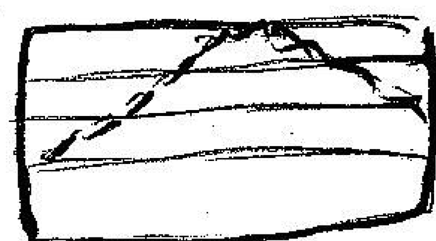
هندسة كهربائية - تركيز اتصالات

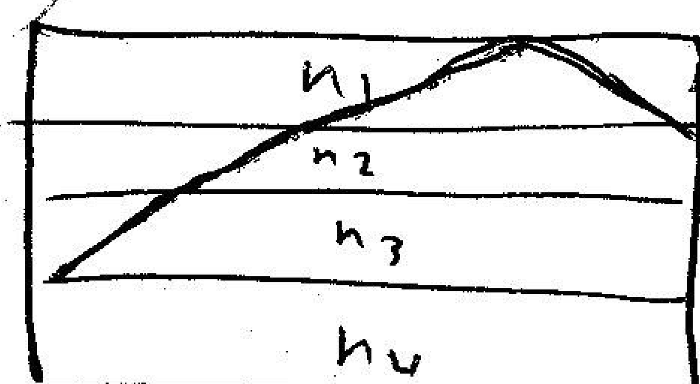
Specialization:	Telecom. Engineering		Palestinian National Authority Ministry Education & Higher Education Palestine Technical University College of Engineering & Technology
Course Name:	Fiber Optics		
Date:	16/012/2012		
Time:	08:00-9:00		Second Exam First semester 2012/2013
Instructor:	Dr. Mutamed Khatib		
Name:	معن سلام محمود قعدان	Section: 1	Mark: 24 /30

[redacted]

Q1. *(4 marks)* Explain the advantages and the principle of GRIN fiber

GRIN fiber : This kind of fiber uses different values on n, so the light inside the fiber transfers as sinusoidal waves inside it.
This technique helps us to save the transmitted light and save the maximum power transmitted and decrease the losses as possible as we can, and save the light not to be reflected as possible we can.





4

Q2. *(4 marks)* Define dispersion, how it can be avoided?

Dispersion: It is a phenomena of the velocity varying in the wave lengths transmitted inside the fiber.

We can avoid this phenomena by :-
1. Use fibers that has a smaller spectral length.
2. Use bandwidth filters (to control in n & λ)
3. Use soliton (fiber changes its index according to intensity).

4

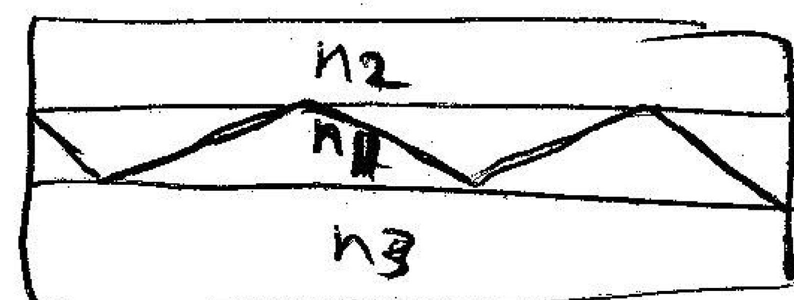
Q3. *(4 marks)* Define critical angle, how it may be obtained?

$\sin\theta_c = \frac{n_2}{n_1}$

Critical angle : it is the angle that a total reflection happened in its value.

$\sin\theta_c = \frac{n_2}{n_1}$

4



We can obtain it when $n_1 > n_2 > n_3$ inside the fiber, so we guarantee a total reflection of the light, and decreases the losses as possible as we can.

Q4. *(4 marks)* What are the conditions for the light to be trapped in the dielectric slab wave guide

① Θ must be equal or greater than the two angles used inside the dielectric slab W.G.

② The boundaries must be smooth to avoid diffuse reflections.

③ The film must be homogeneous.

④ The material absorbation must be small.

4

~~Q5. *(4 marks)* What are the conditions to ensure that the light is totally trapped in the dielectric slab waveguide?~~

مكرر
نفس السؤال
السابق

Q6. *(4 marks)* What are the conditions to ensure efficient edge coupling?

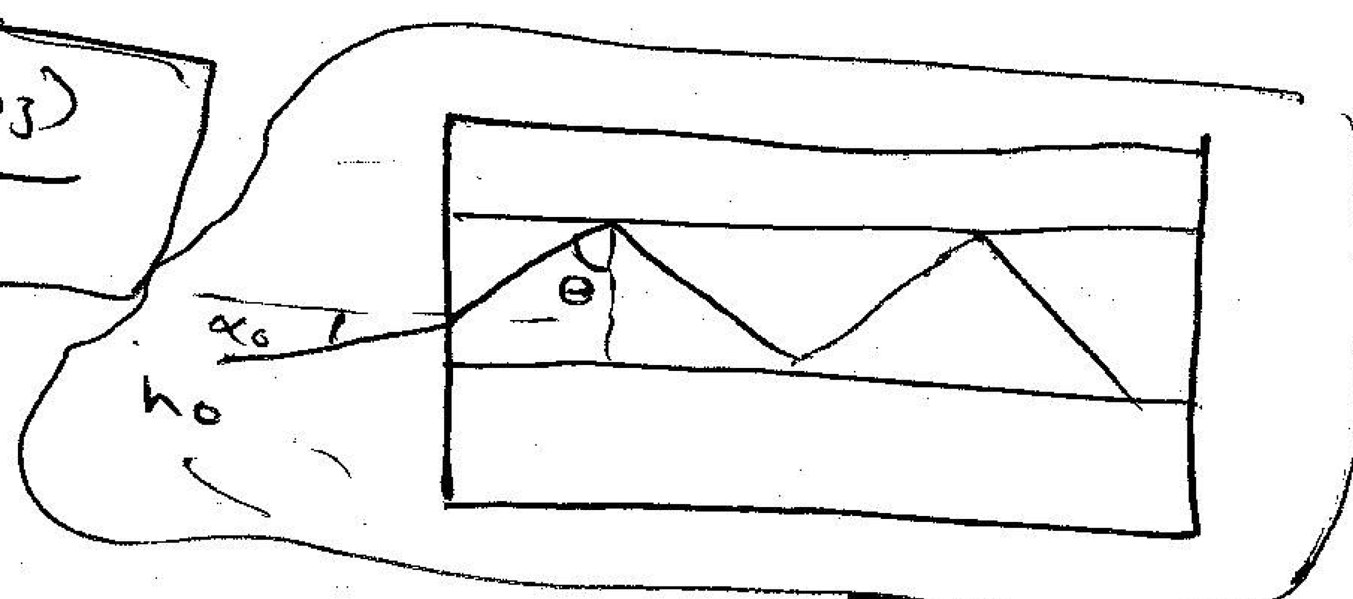
① the emitting light area must be equal to smaller than the film

② n_1 must be greater than n_2 & n_3 to maintain good transfering of light

$$\sin\Theta_c = \frac{\max(n_2, n_3)}{n_1}$$

2

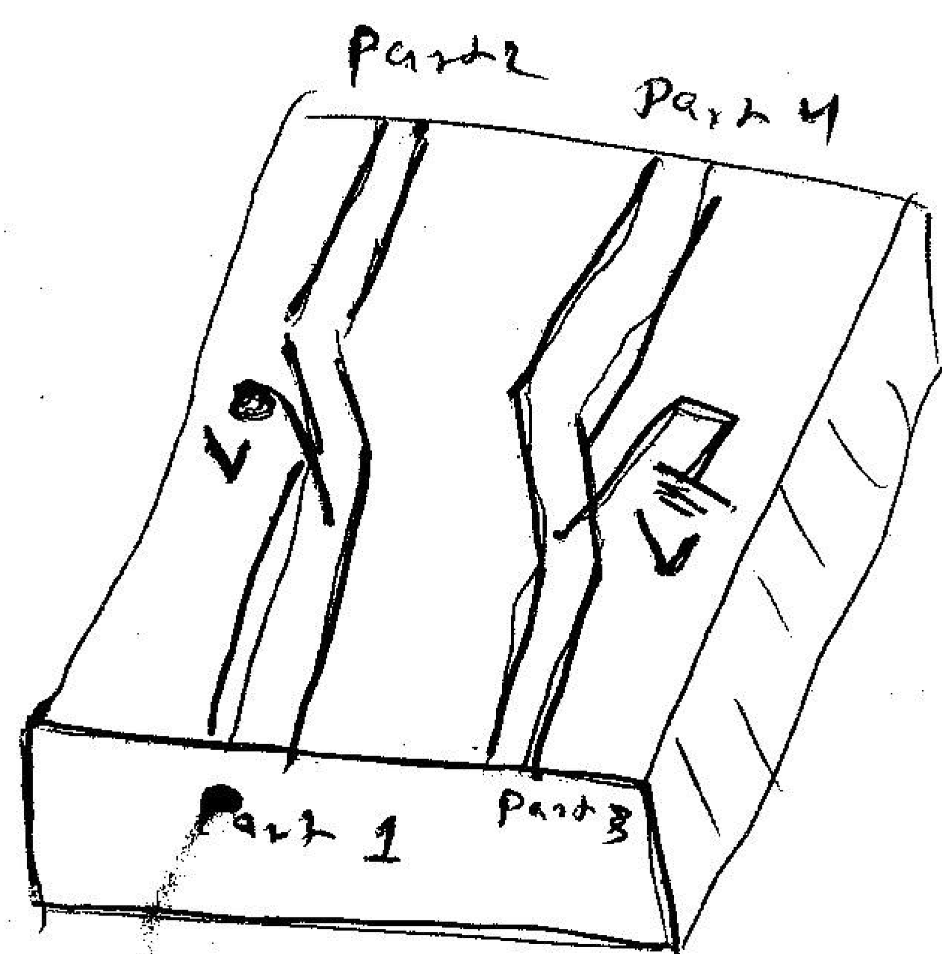
$$n_0 \sin\alpha_0 = n_1 \cos\Theta$$



~~[illegible]~~

③ use a boundary that have good a dielectric and have maximum transmission and small reflection

Q7. *(4 marks)* discuss working principle of active directional coupler



The active directional coupler principle depends on if we apply a voltage on the switchings or not when we do not apply a voltage on the coupler the light transfers to part 2 as usual, but when we apply a voltage on the coupler, the index of the switching will be changed according to the effective $\vec{E}$ that produced, and the light track will be changed and will have another track than part 2, it will take a track of part 1 (electro-optic) and (acousti-optic) effections effects the active directional coupler.

Q8. *(4 marks)* Discuss cladding mode?

the cladding mode is so important in the fiber optics, so that the cladding protects fiber core from external circumstances.

1. it severe proplem that arise when attempting to setup structure.
2. protect fiber from contaminations and other circumstances.
3. fiber may be bend or scrackes, the cladding provide some protection here
4. cladding boundary keep light inside the core and reflect the light, and get back it to the core and keep the power in its maximum condition.

SI fiber has 3 - common cases :-

Page 3

1. glass core, with glass cladding, lower losses and short spreading period (good for long distances).
2. glass core, with plastic cladding; higher losses and longer spreading period (good for shorter distances).
3. plastic core, with plastic cladding, it is used only for the shortest distances